

The MODIS Aerosol Algorithm, Products, and Validation

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ABSTRACT

The Moderate Resolution Imaging Spectroradiometer (MODIS) aboard both NASA's *Terra* and *Aqua* satellites is making near-global daily observations of the earth in a wide spectral range (0.41–15 μm). These measurements are used to derive spectral aerosol optical thickness and aerosol size parameters over both land and ocean. The aerosol products available over land include aerosol optical thickness at three visible wavelengths, a measure of the fraction of aerosol optical thickness attributed to the fine mode, and several derived parameters including reflected spectral solar flux at the top of the atmosphere. Over the ocean, the aerosol optical thickness is provided in seven wavelengths from 0.47 to 2.13 μm . In addition, quantitative aerosol size information includes effective radius of the aerosol and quantitative fraction of optical thickness attributed to the fine mode. Spectral irradiance contributed by the aerosol, mass concentration, and number of cloud condensation nuclei round out the list of available aerosol products over the ocean. The spectral optical thickness and effective radius of the aerosol over the ocean are validated by comparison with two years of Aerosol Robotic Network (AERONET) data gleaned from 132 AERONET stations. Eight thousand MODIS aerosol retrievals collocated with AERONET measurements confirm that one standard deviation of MODIS optical thickness retrievals fall within the predicted uncertainty of $\Delta\tau = \pm 0.03 \pm 0.05\tau$ over ocean and $\Delta\tau = \pm 0.05 \pm 0.15\tau$ over land. Two hundred and seventy-one MODIS aerosol retrievals collocated with AERONET inversions at island and coastal sites suggest that one standard deviation of MODIS effective radius retrievals falls within $\Delta r_{\text{eff}} = \pm 0.11 \mu\text{m}$. The accuracy of the MODIS retrievals suggests that the product can be used to help narrow the uncertainties associated with aerosol radiative forcing of global climate.

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